Bureau of Standards
OCT 8 1923

HGB:AER

DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
WASHINGTON

Reference book not to be taken from the Library.

Technical News Bulletin No. 78

October 8, 1923.

GENERAL NOTE

Owing to the current nature of the investigations mentioned in the Technical News Bulletin, sometimes it will be impossible to supply printed information regarding them. However, in these cases, when the investigation has progressed sufficiently far, the Bureau will be pleased to furnish technical data to those engaged in the particular application of the subject, in order to avoid the delay incident to publication.

---

1 Explosion in Dynamometer Laboratory

On the afternoon of September 20 a violent explosion occurred in the dynamometer laboratory of the Bureau of Standards. One member of the scientific staff was killed instantly and three others died that night as the result of their injuries.

An automobile engine was being operated in one of the altitude chambers, the work forming part of an investigation of fuel performance under low temperatures, simulating winter conditions. Fuels of different volatility were being tested and aviation gasoline was in use at the time. It is believed that a small amount of this gasoline escaped into the chamber, and the resulting mixture of air and gas was ignited by backfiring of the engine.

The explosion and subsequent fire resulted in the destruction of the altitude chamber and much of its equipment, but owing to the prompt action of those on the scene in controlling the fire and to the large area of the windows which saved the walls from the full effect of the explosion, the damage to the building itself was much less than might have been expected. Some strenuous work will be needed in getting portions of the plant back into working order, but it is hoped that no material delay will result in the Bureau's research program.

2 Plaster and Stucco Investigation

During the past 10 years investigations have been conducted at the Bureau with the object not only of improving stucco but of developing more permanent and pleasing finishes of this type for residence construction. The results of this work have formed the basis to a large extent of the "Recommended Practice for Portland Cement Stucco" adopted this year in revised form by the American Concrete Institute.

In the summer of 1922 a group of 10 new experimental panels, each approximately 9 by 16 feet, was erected on the Bureau's test structure to compare the effects of various types of reinforcing lath and fabric, commonly used as bases for cement stucco. While these panels were a disappointment in respect to freedom from defects, they served to concentrate attention upon the importance of the method of attachment of the lath or fabric to the supporting wood frame, and also to the value of applying and "curing" the stucco according to correct principles.

The suggestions from the 1922 investigation, together with a mild controversy as to the merits of sheathing versus no sheathing on stucco houses, led the Bureau to plan a new investigation which might establish with greater certainty some of the questions now in dispute. Upon taking up the matter with interested associations and manufacturers, a very lively interest was shown, and as a result the cooperation of the National Lumber Manufacturers' Association, the Portland Cement Association, the Associated Metal Lath Manufacturers, and a number of individual manufacturers of wire lath and fabric has been obtained in furthering the investigation.

The work is now in progress and involves the replacement of 32 of the old panels on the stucco test building. New panels will be erected during the favorable weather conditions which usually prevail in Washington at this season, and it is expected that these will be completed early in November,

3 Physical Properties of Building Stone

The Bureau has continued its weathering tests on limestone and sandstone, although there have been some unavoidable interruptions during the past month. Several of the limestone specimens have passed 1000 freezings without showing any appreciable signs of disintegration. The tests on sandstone were started at a later date, but some specimens have reached 500 freezings with the samples of the better grades still in good condition.

A series of tests is in progress to determine the effectiveness of various stone preservatives. For this work specimens of limestone treated with various waterproofing materials are employed. These are alternately soaked in a 15% solution of sodium chloride and dried at 104°F., the crystallization of the salt giving an action similar to

that of frost. A parallel series of treated specimens is being exposed to the weather and will be tested in the salt solution after periods of one and two years' exposure. In this way the preserving action of the treatments when first applied and also after they have been exposed to the weather for a considerable time will be determined.

4 Effect of Spacers on the Bonding Strength of Masonry

Spacers are sometimes used between the stones in masonry construction to insure joints between courses of uniform thickness. One of the materials used for this purpose is sheet lead cut into small squares or octagon shapes. Wood is also occasionally employed. In practice these spacers are placed on top of each course before the mortar is spread, and the question has arisen as to whether this affects the bonding strength of the mortar. In order to obtain information on this point, the Bureau has conducted some preliminary tests, using limestone bonded together with a natural cement and with lead buttons and wood spacers. The results thus far obtained indicate that these spacers seriously interfere with the bonding of the cement. This is probably due to the fact that the spacers hold the stones apart so that the mortar in setting shrinks away from the stone.

5 Durability of Various Kinds of Building Stone in Service

In order to obtain information on the durability of various kinds of building stone in actual service, an inspection trip was recently made by a member of the Bureau's staff covering 7 cities. About 200 masonry buildings were examined, which illustrate the use of approximately 40 different building stones. As far as possible the dates of construction were ascertained and the stone identified. A few cases of stone decay were found in quite recently constructed buildings. This appeared to be due principally to a recrystallization of soluble materials which had been leached out of the mass of the stone work or the mortar and deposited as an effloresence in certain places at or slightly beneath the surface of the stone. This phenomenon occurs frequently under the water table and under the cornice. It has been noted on structures of different types of stone, but most frequently on those of sandstone. It has been duplicated in the laboratory by placing blocks of stone partly immersed in a weak solution of sodium sulphate. The salt is carried up in solution through the pores in the stone by capillarity, and is deposited in crystals on or slightly beneath the surface wherever evaporation occurs. These crystals expand in forming and cause disintegration of the stone in a manner similar to that of frost but at a much faster rate.

6 The Nick-Bend Test for Wrought Iron

Previous numbers of the Bulletin have mentioned the investigation which the Bureau has been conducting on the nick-bend test for wrought iron. This work has now been completed, and the results are being prepared for publication.

The materials examined represent the regular finished product of 5 different manufacturers, an intermediate stage in wrought iron manufacture from a sixth source, a wrought iron of unusually high phosphorus content, and a commercially pure iron, designated as "open-hearth" iron. Twelve materials in all were tested. The methods used for fracturing the uniformly nicked bars varied from a slowly applied transverse bending stress to a severe single-blow impact stress, a range permitted by most current American specifications.

This work has brought out the fact that the rate of application of the stress used in rupturing the nicked bars is one of the most important factors affecting the results of the test. Likewise, the appearance of the fractures of nicked bars broken by impact is dependent upon the character, particularly the extent, of the notch to a very marked degree. The depth and length of the notch relative to the specimen tested should be carefully regulated. This can be done more readily by notching in a press with a special chisel than by hand.

The size of crystalline areas in the fractures of the wrought iron is closely associated with the relative size and distribution of the slag threads. There were two distinct types of crystalline areas produced in the "nick-bend" test, one on the tension and one on the compression side of the bar. The one on the tension side indicates certain characteristics of the material, but the other does not.

The results of the notched-bar impact tests of ferrite (open-hearth iron) indicate that an increase in grain size such as occurs upon annealing is not necessarily accompanied by low impact resistance. Wrought iron with a high phosphorus content, although it showed a considerably lower resistance to impact, exhibited no unusual features in the nick-bend fracture which could be considered as significant of the unusual composition of the material.

Bars which had been permanently stretched before the application of the nick-bend test gave no indications, so far as the characteristic features of the fracture were concerned, of the preliminary treatment to which they had been subjected. The cold work very materially strengthened such bars, however, so that a much more severe blow was necessary to fracture them. No unusual features were observed in the fractures of bars of different cross sections to indicate that the size of the bar need be considered in the nick-bend test as ordinarily carried out in practice.

The ordinary methods used in mechanical testing failed almost entirely in the case of wrought iron to give any indication of the features shown by the nick-bend test, but this did not hold true for open-hearth iron.

In general, the results obtained indicate clearly the need for defining more strictly the conditions under which the nick-bend test should be carried out in most current American specifications. In particular, the manner of application of the stress should be definitely stated. Only in exceptional cases will the same type of fracture for wrought iron be obtained with simple transverse bending as with impact. The nick-bend test as often carried out is an approximation of the notched-bar impact test. In the testing of plates or flat bars the relation of the location of the notch to the slag plates ought to be specified, that is, whether upon the edge or flat side of the plate.

7 Molding Sand Investigation

In connection with the investigation which the Bureau has been carrying out on foundry molding sand, some interesting work is now under way on the effects produced by adding clay and silica sand, ranging from 10 to 50 per cent, and variable amounts (4 to 10 per cent) of water, to a used foundry sand. It has been shown by the test methods in use that by adding 40 per cent of clay, 25 per cent silica sand to the used sand, and tempering the batch with 8 per cent of moisture, a bond strength and permeability can be attained equal to that of a good brass molding sand. Further tests are in progress to determine the best methods for removing sea-coal and other undesirable impurities from a used foundry sand.

8 Trial Run of New Cupola Furnace

As mentioned a short time ago, the metallurgical division of the Bureau has recently installed a small cupola furnace for melting cast iron, which will be of great value in connection with its research work on ferrous metals. A trial "run" of this equipment was made during the past month. It was found possible to melt the cast iron ready for pouring within four hours after starting the fire. Three hundred pounds of iron have been melted and poured into test bars and pigs. The character of the iron has not yet been determined, but so far as the operation and behavior of the furnace are concerned, the trial run was a pronounced success.

9 Cast Iron for Enameling Purposes

In connection with the Bureau's investigation of the enameling of cast iron, several typical castings have been received and have been coated with representative enamels. This work is still in progress, and all the castings will be examined for blistering. Microphotographs will be made of the surfaces in order to detect any changes produced by the enameling operation. It is hoped that the cause of blistering of these castings will be discovered, and means developed to control and if possible eliminate it.

10 Electrolytic Method for Altering Map Plates

The electrolytic method for altering map plates developed by the Bureau and briefly described in item 17 of Bulletin No. 63 has proven satisfactory for the use of the Coast and Geodetic Survey. The Hydrographic Office of the Navy Department now has under consideration the installation of a plant employing the same process.

11 Use of Glue in Paper Coating

The Bureau is carrying out some experiments dealing with the use of glue in coating paper. During the past month 9 runs have been made on the experimental coating machine, using 2 makes of bone glue for 8 of the runs and a French casein glue for one. The clay used for all runs was Lee Moor, a good grade of English coating clay. The results indicate that the water resistance of glue-bound coating containing chrome alum compares favorably with that of casein-bound paper containing no formaldehyde. It is believed that the degree of waterproofness will prove sufficient for most of the papers used for halftone printing. Difficulties have been experienced in obtaining a uniform coating, because of variation of the fluidity of the coating mixture and mechanical defects in the machine, so that additional work will be necessary before paper suitable for printing tests can be produced.

12 Effect of Sea Water on Glass

Some work was carried out during the past month on the effect of sea water on various types of glass, to determine the best kind to use for the lenses of signal lights on shipboard. From the data which the Bureau has secured, the damage which these lenses often suffer appears to be caused by the evaporation of sea spray, which leaves a deposit of salt on the surface of the lens. This eventually etches the glass. Three types of glass, boro-silicate, lead glass, and ordinary soda-lime glass, have thus far been investigated. Under the conditions of the test, lead glass etched considerably, while the other two did not.

13 Detector for Water Vapor in Closed Pipes

A description of a device for the detection of water vapor in closed pipes, developed at the Bureau, is described in Industrial & Engineering Chemistry, 15, 931; 1923. An abstract of this article is as follows:

"A simple device is described for determining the approximate concentration of water vapor in a gas. A glass tube is coated with platinum and the coating divided by etching into two electrodes. Platinum wires sealed through the glass connect the electrodes to a measuring circuit. The resistance to alternating current of a thin film of hygroscopic electrolyte bridging the gap between the electrodes is used as the measure of the water vapor in the atmosphere with which the film is in contact. Sulfuric and phosphoric acids and various hygroscopic salts can be used in forming the conducting film. The detector is simple, rugged, and easily adapted for use in high-pressure piping

in which the determination of water vapor is usually attended with difficulty. Laboratory experiments showing the reliability, method of application, and limitations of the device are described.

14 U. S. Petroleum Oil Tables

Letter Circular 101, of the mimeographed series of the Bureau of Standards, has just been issued and consists of tables to be used in calculating the volume which an oil will occupy at 60°F. temperature, when the degrees A.P.I. at 60° and the volume at any given temperature are known. For example, if the A.P.I. gravity of an oil at 60°F. is 22, and its volume has been found to be one gallon at 105°F, its volume at 60° will be found to be 0.9822 gallon.

The values in the body of the table are in the form of "multipliers," that is, the volume of the oil at the indicated temperature and degrees A.P.I. multiplied by the corresponding factor in the table equals the volume at 60°F. The tables can also be used to calculate the percentage change of volume to reduce to 60°F. The percentage factor is 100 times the difference between the tabulated value and unity.

The results on which these tables are based were secured during an investigation conducted by the Bureau on the density and thermal expansion of American petroleum oils and published as Technologic Paper No. 77. The same data were used in computing the tables published in Circular No. 77, "United States Standard Tables for Petroleum Oils." Both these publications may be obtained from the Superintendent of Documents, while those desiring copies of Letter Circular 101 should apply to the Bureau direct.

15 New Micrometer for Accurate Measurements

A micrometer of extraordinary accuracy has been constructed by the Bureau of Standards for determining the diameter of some 12-inch porcelain cylinders to be used in electrical measurements. Measurements made with the new instrument are independent of the observer and have an accuracy of 0.0001 of an inch. In order to obtain this degree of accuracy, it is necessary to operate the micrometer from a distance and to take readings from it through a telescope so that the heat of the observer's body will not warp the thick iron ring enough to cause an error. Both the instrument and the cylinder which it is employed to measure must be kept in a constant-temperature box during the measurement. The micrometer consists of a cast iron ring large enough to pass easily over the 12-inch cylinders. On opposite sides are the micrometer screw and the contact pin, while at right angles to these are adjustable lugs for centering the device on the cylinder.

The micrometer screw is driven by a tiny electric motor and the ring with its attachment, including the motor, is suspended by three light rods and can move freely for a short distance.

In making a measurement the micrometer screw is revolved by the motor through a train of gears, the motion of the screw pushes the cylinder against the contact pin and when this contact is made, the motor circuit is broken thus stopoing the screw. The cylinders which are to be measured will be wound with wire on a precision lathe and will form inductance coils of very accurate construction, the inductance of which can be calculated from the dimensions. They will be used for research work in a program for standardizing all of the electrical units in terms of the fundamental standards of length, mass, and time.

16 Electrical Strain Gages

The Bureau has recently completed the work of assembling, testing, and calibrating 36 electrical strain gages for the Bureau of Aeronautics of the Navy. These gages, together with 24 others previously supplied to the above Bureau, were recently installed on the Navy dirigible ZR-1 at Lakehurst, N. J., under the direction of a representative of the Bureau of Standards. These gages are being used for the continuous measurement of stresses in various parts of the dirigible during flight.

17 Measurements of Frequencies of Radio Transmitting Stations

In order to assist the Radio Inspection Service in maintaining stations on their licensed frequencies, the Bureau of Standards makes daily measurements of the emitted waves from various stations. The measurements to date have been mainly on Class B broadcasting stations and on the low-frequency high-power transoceanic stations. The measurements show in general a gratifying degree of adherence to the assigned frequencies. In a few cases where the observation showed stations to be seriously off the assigned frequency, the Supervisors of Radio have readjusted the stations so as to bring them within the required tolerance.

In only a few cases are the stations maintaining without exception the assigned frequencies so closely that the wave can be used as a frequency standard. Special attention is being given by the Bureau to the stations which do maintain such standards, and an announcement will be made later in the Radio Service Bulletin stating the degree of constancy that has been observed, so that persons may utilize the transmissions from these stations as a standard for the calibration of apparatus.

The method used by the Bureau in measuring the frequency of distant stations involves the use of a local radio-frequency generator. This is adjusted to the same frequency

as the received wave from the transmitting station, this adjustment being determined by receiving both frequencies in a receiving set and varying the local generator until a zero beat note is obtained. The frequency of the local generator is then measured with a wavemeter.

Further details of the method are given in Bureau of Standards Letter Circular 92 "Radio Signals of Standard Frequency and Their Utilization." A limited number of copies is available at the Bureau and can be obtained by those having actual use for this information. The results of the Bureau's measurements of the station frequencies are furnished only to the Radio Inspection Service.

18 The Adjustment of Automobile Headlights

In the past numbers of the Bulletin, some attention has been given to the work which the Bureau of Standards is conducting on the better adjustment of automobile headlights. In addition to the work carried out locally in the District of Columbia, the Bureau is sponsoring a national movemebt to secure headlight adjustment. A representative of the Bureau emphasized the importance of the member club activity in this matter at a meeting of officials of the National Motorists Association in Cleveland, September 20, 21, and 22. This Association and the American Automobile Association, as well as all similar organizations, are in a particularly favorable position to place before motorists the necessity for headlight adjustment. The problem has also been discussed in the broadcasting programs which the American Automobile Association sends out through radio station WRC.

The National Automobile Chamber of Commerce is calling the attention of motor car manufacturers to the necessity of closer supervision of their dealer and service activities so that the two or three million new cars turned out annually will have properly adjusted headlights. The Motor and Accessory Manufacturers' Association has made a similar offer to get in touch with headlight manufacturers to insure the furnishing with all headlight devices of simple and adequate instructions for their adjustment. The Society of Automotive Engineers is giving active support through its Standards Committee, particularly along the lines of standardizing and improving headlight construction.

If all headlights could be focused in the same manner, this would simplify the instructions required and facilitate adjustment. In fact any action taken which may make adjustment easier will be a step forward.

All the national associations approached have stated that they would actively back a national campaign for headlight adjustment, and some States already have such campaigns under way. Action of this sort should be given all possible support, since proper road lighting will not

only reduce the number of accidents, but will make night driving more agreeable. If headlights are adjusted now, a mass of restrictive legislation will be avoided later on.

19 Survey of the Government's Telephone System

The work accomplished by the Bureau of Standards in its survey of telephone service in the Government departments at Washington, undertaken at the request of the Bureau of the Budget, was so successful that it was deemed advisable to extend it to the Federal buildings in other cities. During the past month numerous questions dealing with the situation in Washington, such as the relocation of switchboards and other changes which will improve the service and decrease expenditures, have been referred to the Bureau for investigation.

In Baltimore a study of service conditions is being carried out and conferences will be held in the near future in connection with the consolidation of service in the Post Office Building and in the Custom House, the relocation of the Post Office switchboard, and the more complete utilization of private lines leased by the Government for toll service within the Government system.

At the request of the Chief Coordinator, the Coordinator for the First Corps Area with headquarters at Boston, undertook the task of sending out and collecting questionnaires covering telephone service in that city and rendered such assistance in their preparation as was necessary. These questionnaires, together with other material,have been received at the Bureau, and an analysis of the Boston situation has been commenced.

In Norfolk, Va., work has been confined to a study of possible economies in the Government telephone service between that city and other Government points.

20 Aeronautical Safety Code

Part 5 "Airdromes and Airways," Part 8 "Balloons (Free and Captive)," and Part 9 "Airships" of the American Aeronautical Safety Code have been printed for preliminary distribution and discussion. The preparation of this code is being carried out in accordance with the scheme of procedure of the American Engineering Standards Committee, the Bureau of Standards and the Society of Automotive Engineers being joint sponsors for the project.

The subcommittee on Airplane Structure, Part 1 of the code, met at the Bureau of Standards on September 26 and reviewed the first draft of this important section. Persons interested in this section of the code are urged to communicate with the Bureau making suggestions and criticisms.

21 Preparation of Dictionary of Specifications

The work which the Bureau of Standards is carrying out on a dictionary of specifications has made good progress. During the past month existing specifications have been

collected from more than 75% of the important national technical societies, trade associations, and governmental publishing agencies that have issued specifications. A fairly accurate estimate can now be made of the total number of available specifications for use in preparing the dictionary. Leaving out all duplications, it would appear that about 5000 specifications are available from the above sources. However, not all of these specifications can properly be classed as related to commodities purchased by the Federal, State, and municipal Governments and public institutions. It is believed that about 20 000 commodities do come within this class and of these more than 75% of all commodities purchased for Government consumption are now covered by available specifications.

Work is being expedited on the collection of existing specifications with the object of making the collection as complete as possible so that the first step in the preparation of the dictionary, the issuance of a classified list of existing specifications, may soon be taken. This will be of considerable service to all agencies interested in this subject, and with the cooperation of the advisory board will be used as the basis for selection of specifications for inclusion in the dictionary.

22 Determination of Total Sulfur in Rubber Goods

A method for the determination of total sulfur in rubber goods is described in an article in Industrial and Engineering Chemistry, 15, 953; 1923. A brief summary is as follows:

"The Bureau of Standards method, by Waters and Tuttle, for the determination of sulfur in rubber goods has been modified as follows: Fifteen cubic centimeters of nitric acid-bromine mixture added to the sample and evaporated to dryness. Three cubic centimeters of nitric acid and 5 grams of sodium carbonate are added and the resulting mixture is dried and fused. The fused mass is lixiviated with water, filtered, the filtrate acidified with hydrochloric acid, and diluted to 300 cc and the sulfur determined in the usual manner.

"The amounts of occlusion, when the methods of the Bureau of Standards and of Kratz, Flower, and Coolidge are used, were determined by precipitating barium sulfate from solutions containing the equivalent amount of salts usually present, and varying amounts of pure sodium sulfate. The results show that the amount of occluded salts must be corrected for use in accurate work.

"The sulfur in several compounds, containing litharge and barytes, was determined by both methods. After correction for occlusion, the results obtained by either method are practically the same and sufficiently accurate."

PUBLICATIONS OF THE BUREAU OF STANDARDS RELEASED DURING SEPTEMBER.

Scientific Paper

S 475 Visibility of radiant energy. K. S. Gibson and E. P. T. Tyndall 15¢

Technologic Paper

T 238 Some compressive tests of hollow-tile walls. Herbert L. Whittemore and Bernard D. Hathcock 5¢

These publications can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the prices given above.

Respectfully,

George K. Burgess, Director
HGB